

Final Report for NASA RXTE AO-1 Proposal:  
"Deep and Monitoring Observations of the Black  
Hole Candidates 1E 1740.7-2942 and  
GRS 1758-258"

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June 3, 1998

The purpose of this effort was to obtain detailed information on the long term variability of the power spectra and energy spectra of the two Black Hole Candidates (BHCs) and so-called "micro-quasars", 1E 1740.7-2942 and GRS 1758-258. Observations with the pointed instruments on the *Rossi X-ray Timing Explorer (RXTE)* were carried out on a weekly basis for an entire year, in order to observe the extent to which these sources changed on long timescales. The observations also served as a trigger for longer observations carried out under a sister proposal "Target of Opportunity Observations of the Black Hole Candidates 1E 1740.7-2942 and GRS 1758-258". The work done at UCSD by W. Heindl consisted first of monitoring the data from the High Energy X-ray Timing Experiment (HEXTE) to determine when the sources were bright enough to trigger our Target of Opportunity observations. He was then responsible for the reduction and interpretation of the HEXTE data and for contributing to the publication of results of this work.

The results of this work have appeared as a conference paper (Smith *et al.*, 1997) and are the subject of a paper in preparation for a refereed journal.

Historically, these objects have been highly variable on long timescales. Observations between 1988 and 1995 found that they tend to spend periods of several months in high and low flux states which differ in luminosity by more than an order of magnitude. In more than 2 years of *RXTE* observations to date, we have found variability only on the level of tens of percent. Both sources have remained near their historical maximum luminosities during this time. This is a significant change from previous behavior, and indicates that their accretion rates have stabilized in recent years. In addition, their observed spectra have been quite stable. The spectra are quite hard, having photon indices of  $1.53 \pm 0.06$  and  $1.54 \pm 0.04$  for 1E 1740.7-2942 and GRS 1758-258 respectively. Both spectra are exponentially cutoff at high energies and show some excess soft emission and a weak iron line. These spectra are quite similar to the low

state of the canonical BHC, Cyg X-1. Their constancy of both flux and spectral shape make these objects a class of two. They are the only radio jet black holes which remain consistency in the X-ray low state.

## PUBLICATIONS

Smith, D.M., Main, D., Heindl, W.A., Swank, J., Leventhal, M., Mirabel, I.F., and Rodriguez, L.F. (1997), presented at the High Energy Astrophysics Division of the American Astronomical Society (November 1997, Estes Park, Colorado).

Smith, D.M., Main, D., Heindl, W.A., Swank, J., Leventhal, M., Mirabel, I.F., and Rodriguez, L.F. (1998), in preparation.